

Nutritional status of selected obese school going children in Western Maharashtra

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Nutritional status of obese school going children were assessed in Western Maharashtra *i.e.* Pune, Nashik and Ahmednagar districts. For this study, 600 obese school going children were selected, from which 224 boys and 376 were girls in 6-16 age group of 6-16 years. The obesity of these children were assessed by using BMI. The nutritional status of these children were examined by using questionnaire and dietary recall method. It is found that the food intake especially cereals, pulses and fat based foods are found significantly excess and vegetables and fruits consumption noted less by these children. However, the nutrients intake like energy and protein were noticed excess than that of their standard level. Whereas vitamins and minerals intake were found less among these children which were as correlating factors for its effect on overweight and obesity in children.

Key Words : Childhood obesity, School going obese children, Nutritional status, Food intake

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INTRODUCTION

Obesity is a complex problem related to food habits as well as fats accumulated by child which increase weight more than normal. It has been observed that “Childhood obesity is a condition where excess body fat negatively affects a child’s health or well-being” (Kopelman, 2005).

Obesity is a universal problem having different ramifications national, regional and local. The pace at which the obesity epidemic is threatening the world’s children and adolescents has raised immediate public health concern. Scholars have studied obesity and overweight in their own perspective. “The term

overweight rather than obese is often used in children as it is less stigmatizing” (Bessesen, 2008). Due to availability of square food and affinity of parents the school children are provided more nutritious food than they require, which leads to complex situation of obesity.

According to the estimation of prevalence of overweight and obesity among school aged children aged 5-17 years collected by the international association for the study of obesity, one in five children is affected by excess body weight across all countries and in Greece, United States and Italy, the figure is closer to one third. Only in China, Korea and Turkey 10 per cent or less of children are overweight. In most countries, boys have higher rates of overweight and obesity than girls (International Association for the study of obesity, 2014). It seems in most of the countries the problem of obesity and fatness is prevailing and it requires scientific treatment. In the last few decades, the childhood obesity has tripled and it has reached epidemic levels in

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developed countries (Ogden *et al.*, 2010). Thus in developed countries nutrition facilities are available and parents do not care regarding square meals and balanced calories. About 10 per cent of school children aged between 5 to 17 years around the globe are overweight, out of which 70 per cent grow up to become obese adults (Kuczmarski and Flegal, 2000 and Flegal *et al.*, 2002). It shows the problem is critical and burning in all the parts of the world. The negative life style, lack of physical activity and consumption of unhealthy foods are contributing factors for childhood over weight and obesity (Kumar *et al.*, 2007). Studies in the US have observed a change across the age groups that they consume a large proportion of their daily food intake via snacks rather than sit- down meals, favouring quick, easy –often non-nutritious-foods and high-calorie treats be it in the form of processed foods, street foods, fast foods or junk foods (McMaster *et al.*, 2004 and Anupama *et al.*, 2015). Hence, nutritional profile of the children is very important factor In other words young children are making unhealthy eating choices and are not getting enough physical activity (Wechsler *et al.*, 2004). Recent data from (World Health Organization, 2007) revealed that the prevalence of childhood obesity worldwide is 16.5 per cent and in India it accounts to 12.4 per cent in boys and 9.9 per cent in girls. According to Knoon (2002), the prevalence rates of overweight (12.8 %) and obesity (10.3 %) among children in India is an alarming situation due to improper nutritional profile (Knoon, 2002).

Against this background, the present study was undertaken to assess the nutritional status especially eating habits of overweight and obese children and reasons for accepting junk food always.

METHODOLOGY

An exploratory research has been conducted in three districts such as Pune, Ahmednagar and Nasik of Western Maharashtra. Total 600 (obese) children among obese children having age between 7 to 12 years including male and female were selected by (purposive) simple random sampling method. About 200 obese children were randomly selected from each district. Out of 600 obese children 224 were male and 376 were female. The obese children were selected by calculating BMI through school information of height and weight of children with prior permission of principal.

All the anthropometric measurements were taken

in the school premises with standard procedure. We have recorded body weight to the nearest 0.1 kg using a standard balance scale with subjects barefoot and wearing light indoor clothing. Body height was measured by scale was used upto an accuracy of 1 mm. Body Mass Index (BMI) is defined as the ratio of body weight to body height squared, expressed as kg/m². Overweight and obesity was assessed by BMI for age. Student who had BMI for age >85th and <95th percentile of reference population were classified as overweight. Students who had BMI for age >95th percentile of reference population were classified as obese. The lower cut- off points for Asians were identified for overweight (BMI>23.0 kg/m) and obesity (BMI>25.0kg/m) (WHO, 2004). The collected data were pooled, tabulated and analysed statistically.

The 24 hours dietary recall method is commonly used method in large nutritional surveys to collect dietary intake information of the individuals. The food intake within 24 hours were recorded in the structured questionnaire. The type of food consumed, amount of food, method used for food preparation, type of food consumption and other details related to food intake were asked to the mothers of school going children and their memorable replies were recorded. The 24 hours dietary recall was taken for subsequent three days and means of each ingredient was taken as 24 hours dietary recall. From the raw ingredients amounts, the nutritive value of each food item was calculated by using the nutritive values given by Gopalan (2006) and Sodha *et al.* (2015). It was compared with Recommended Dietary Allowances (RDA) of nutrients for those of specific age groups. Along with nutritive value amount of each food group was calculated, recorded and compared with Balanced Dietary Allowance (BDA).

OBSERVATIONS AND ASSESSMENT

The data regarding food intake pattern of school going obese boys of 7 to 9 years age is given in Table 1. It explained that cereal intake by obese boys was noted 207.5g. The per cent of adequacy of cereal was excess as compared with RDA (115.3). The average pulses and legumes were also observed excess *i.e.* 106.7 per cent. However average intake of green leafy vegetables was found very poor as 15g. As compared with their daily requirement, the green leafy vegetables intake was found very inadequate level. Intake of roots and tubers was also

found excess as compared with daily requirements (135g). The intake of fruits and milk were noticed very low adequate level *i.e.* 10 and 42 per cent, respectively. The intake of sugar and jaggery was observed as 49.5g and was found in excess *i.e.* 247.5 per cent. Fats and oils in the diet of school going boys was found 62.5g which was found excess (208.3%). Consumption of non-vegetarian foods *i.e.* eggs, meat/fish/poultry among these school going obese children found non-significantly more than their RDA. It is observed from table that calculated Z values of average intake of cereals, pulses, green leafy vegetables, roots and tubers, fats and oils and sugar and jaggery are negatively significant which may be the leading factors for the obesity among school going boys.

The data regarding food intake pattern of school going obese girls of 7 to 9 years age is given in Table 2. It reveals that cereal intake by obese girls was noted 215g. The per cent of adequacy of cereal was excess as compared with RDA (119.4%) and negatively significant.

The average intake of pulses and legumes were also observed excess *i.e.* 102.5 per cent. However, average intake of green leafy vegetables and other vegetables were found to be very poor as 21g and 75g, respectively. As compared with their daily requirement, the green leafy vegetables intake was found very inadequate level (21%). Intake of roots and tubers was also found excess as compared with daily requirements (122.5g). The intake of fruits and milk were noticed to be very low adequate level *i.e.* 15 and 58 per cent, respectively when compared with RDA. The intake of sugar and jaggery was observed as 50g and was found in excess *i.e.* 250 per cent. Fats and oils in the diet of school going girls was found 60g which was found excess (200%) when compared with RDA. Whereas, non-significantly more consumption of non-vegetarian foods *i.e.* eggs (32.0g) and meat/ fish/ poultry (33.8g) are noticed in these children. Hence, statistically also it is found that the intake of cereal, pulses, roots and tubers, fats and oils, and sugar and

Table 1 : Average intake of food groups by obese boys of 7-9 years age

Food groups	RDA	Average food intake	Z Value	Percent of adequacy
Cereals(g)	180	207.5	-(8.1)**	115.3
Pulses(g)	60	64	-(1.3)NS	106.7
Green leafy vegetables(g)	100	15	-(13.1)**	15
Other vegetables(g)	100	80	(4.9)**	80
Roots and tubers(g)	100	135	-(6.4)**	135
Fruits(g)	100	10	(15.1)**	10
Milk(ml) and milk product	500	210	(8.7)**	42
Fats and oils(g)	30	62.5	-(7.4)**	208.3
Sugar and jaggery (g)	20	49.5	-(8.3)**	247.5
Eggs (g)	30	35.1	-(1.6) ^{NS}	117.0
Meat/fish/poultry(g)	30	34.1	-(1.3) ^{NS}	113.7

** indicates significance of value at P=0.01,

NS=Non-significant

Table 2 : Average intake of food groups by obese girls of 7-9 years age

Food groups	RDA	Average food intake	Z Value	Per cent of adequacy
Cereals(g)	180	215	-(15.6)**	119.4
Pulses(g)	60	61.5	-(0.5) ^{NS}	102.5
Green leafy vegetables(g)	100	21	(12.3)**	21
Other vegetables(g)	100	75	(13.9)**	75
Roots and tubers(g)	100	122.5	-(4.4)**	122.5
Fruits (g)	100	15	(13.1)**	15
Milk (ml) and milk product	500	290	(7.1)**	58
Fats and oils(g)	30	60	-(8.1)**	200
Sugar and jaggery(g)	20	50	-(9.8)**	250
Eggs (g)	30	32.0	-(0.8) ^{NS}	106.7
Meat/fish/poultry(g)	30	33.8	-(0.9) ^{NS}	112.7

** indicates significance of value at P=0.01,

NS=Non-significant

jaggery are negatively significant with RDA.

The Table 3 reveals the information about average intake of food groups consumed by obese boys of 10 to 12 years of age. It is observed that cereal intake by obese boys was noted 325g. The per cent of adequacy of cereal was excess as compared with RDA (108.3%) and negatively significant. The average intake of pulses and legumes were also observed excess *i.e.* 115 per cent when compared with RDA. However average intake of green leafy vegetables was found to be very poor as 27.5g. As compared with their daily requirement, the green leafy vegetables intake was found very inadequate level (27.5 %). Intake of other vegetables and roots and tubers were also found excess as compared with daily requirements *i.e.* 155 and 170 per cent, respectively. The intake of fruits and milk were noticed to be very low adequate level *i.e.* 27.5 and 60 per cent, respectively when compared with RDA. The intake of sugar and jaggery was observed as 62.5g and was found in excess *i.e.* 208.3 per cent. Fats

and oils in the diet of school going boys was found 60g which was found excess (171.4%) when compared with RDA. Non-vegetarian intake *i.e.* eggs and meat/fish/poultry was noted non-significantly more in this age group of obese boys. Hence, statistically also it is found that the intake of cereal, pulses, other vegetables, roots and tubers, fats and oils, and sugar and jaggery are negatively significant with RDA.

The Table 4 reveals the information about average intake of food groups consumed by obese girls of 10 to 12 years of age. It is observed that cereal intake by obese girls was noted 275g. The per cent of adequacy of cereal was excess as compared with RDA (114.6%) and negatively significant. The average intake of pulses and legumes were also observed excess *i.e.* 110.8 per cent when compared with RDA. However average intake of green leafy vegetables and other vegetables were found to be poor as 30g and 150g, respectively. As compared with their daily requirement, the green leafy vegetables

Table 3 : Average intake of food groups by obese boys of 10-12 years age

Food groups	RDA	Average food intake	Z Value	Per cent of adequacy
Cereals(g)	300	325	-(8.0)**	108.3
Pulses(g)	60	69	-(1.8) ^{NS}	115
Green leafy vegetables(g)	100	27.5	(12.1)**	27.5
Other vegetables(g)	200	310	-(16.5)**	155
Roots and tubers(g)	100	170	-(12.7)**	170
Fruits(g)	100	27.5	(14.6)**	27.5
Milk(ml) and milk product	500	300	(5.7)**	60
Fats and oils(g)	35	60	-(5.5)**	171.4
Sugar and jaggery(g)	30	62.5	-(9.2)**	208.3
Eggs (g)	30	31.9	-(0.6) ^{NS}	106.3
Meat/fish/poultry(g)	30	37.1	-(1.6) ^{NS}	123.7

** indicates significance of value at P=0.01, NS=Non-significant

Table 4 : Average intake of food groups by obese girls of 10-12 years age

Food groups	RDA	Average food intake	Z Value	Per cent of adequacy
Cereals(g)	240	275	-(16.1)**	114.6
Pulses(g)	60	66.5	-(4.4)**	110.8
Green leafy vegetables (g)	100	30	(4.3)**	30
Other vegetables(g)	200	150	(2.8)**	75
Roots and tubers(g)	100	165	-(2.6)**	165
Fruits (g)	100	30	(2.8)**	30
Milk (ml) and milk product	500	220	(5.9)**	44
Fats and oils (g)	35	57.5	-(3.9)**	164.3
Sugar and jaggery (g)	30	56.5	-(5.1)**	188.3
Eggs (g)	30	38.3	-(3.4)**	126.7
Meat/fish/poultry(g)	30	32.7	-(1.3) ^{NS}	109

** indicates significance of value at P=0.01, NS=Non-significant

intake was found very inadequate level (30 %) and intake of other vegetables was 75 per cent. Intake of roots and tubers were also found excess as compared with daily requirements *i.e.* 165 per cent. The intake of fruits and milk were noticed to be very low adequate level *i.e.* 30 and 44 per cent, respectively when compared with RDA. The intake of sugar and jaggery was observed as 56.5g and was found in excess *i.e.* 188.3 per cent. Fats and oils in the diet of school going girls was found 57.5g which was found excess (164.3%) when compared with RDA. Consumption of eggs found significantly more *i.e.* 38.3g/day among 10 to 12 years in age obese girls. Whereas, meat/fish/poultry intake reported slightly and non-significantly more than RDA in these girls. Hence, statistically also it is found that the intake of cereal, pulses, roots and tubers, fats and oils, and sugar and jaggery are negatively significant with RDA.

The nutrients intake by school going obese children was calculated from their food intake by use of the standard method. The averages were calculated, compared with RDA of specific age group. The data is

depicted in Table 5 to 8.

The data about average nutrients intake by school going obese boys in the age of 7 to 9 years can be seen from Table 5. It indicates that the average calorie intake by school going boys was noted 2200 Kcal. When this calorie intake is checked at per cent of adequacy level, it was found in excess (*i.e.* 130.2 %). There is negatively significant difference when compared with standards. The amount of protein consumption by school going obese boys was reported 51.5g which is noticed negatively significant more (174.6 %) than that of normal standard. Fat consumption in boys was recorded as 47g and per cent of fat consumption was reported as in excess (156.7%). There is also noticed negatively significantly more than that of their normal RDA.

B-complex vitamins like Vitamin B₁(mg), Vitamin B₂(mg) and Vitamin B₃(mg), Vitamin C(mg) and β-carotene (μg) were also calculated in comparison with their Standards. About 0.9mg of vitamin B₁, 0.9mg of Vitamin B₂ and 11.0mg of Vitamin B₃ consumption were seen in boys. There is no significant difference when

Table 5 : Average nutrients intake by obese boys (7 to 9 years)

Nutrients	RDA	Average nutrient intake	Z value	Per cent of adequacy
Calories(Kcal)	1690.0	2200.0	--(7.8)**	130.2
Protein(g)	29.5	51.5	-(6.6)**	174.6
Fat(g)	30.0	47.0	-(7.6)**	156.7
Vitamin B ₁ (mg)	0.8	0.9	(0.9) ^{NS}	112.5
Vitamin B ₂ (mg)	1.0	1.0	(0.01) ^{NS}	100
Vitamin B ₃ (mg)	13.0	11.0	(1.4) ^{NS}	84.6
Vitamin C(mg)	40.0	34.0	(5.1)**	85
β-carotene(μg)	4800.0	3850.0	(8.9)**	80.2
Calcium(mg)	600.0	390.0	(2.4)*	65
Iron(mg)	16.0	16.5	(0.7) ^{NS}	103.1

* and ** indicate significance of values at P=0.05 and 0.01, respectively

NS=Non-Significant

Table 6 : Average nutrients intake by obese girls (7 to 9 years)

Nutrients	RDA	Average nutrients intake	Z Value	Per cent of adequacy
Calories(Kcal)	1690.0	2025.0	--(8.1)**	119.8
Protein(g)	29.5	46.5	-(6.8) **	253.1
Fat(g)	30.0	44.0	-(8.7)**	146.7
Vitamin B ₁ (mg)	0.8	0.88	(0.09) ^{NS}	84.6
Vitamin B ₂ (mg)	1.0	0.95	(0.01) ^{NS}	110
Vitamin B ₃ (mg)	13.0	11.0	(1.8) ^{NS}	95
Vitamin C(mg)	40.0	38.5	(1.6)**	84.6
-carotene(μg)	4800.0	4180.0	(7.3)**	96.3
Calcium(mg)	600.0	385.0	(3.2)*	87.1
Iron(mg)	16.0	15.0	(0.01) ^{NS}	93.8

* and ** indicate significance of values at P=0.05 and 0.01, respectively

NS=Non-Significant

compared with RDA. The vitamin B₃ consumption in boys was noticed in poor adequate level. The consumption of vitamin C (mg) and β-carotene (μg) were 34 and 3850, respectively. The consumption were notice in poor adequate level *i.e.* 85 and 80.2 per cent, respectively when compared with RDA.

The mineral intake such as calcium (mg) and iron (mg) among school going boys were noted 390 and 16.5, respectively. The intake level of calcium was very less and did not reach their daily intake recommendations. This may be due to many boys showed very less intake of milk.

On the whole, it is seen that the average consumption of major nutrients were excess and minor nutrients were on their borderline or inadequate than their recommended dietary allowances among 7 to 9 years school going obese boys. A similar data about 7 to 9 years school going obese girls was put in Table 6.

Table 6 reveals that the average calorie intake by school going girls was noted as 2025 Kcal. When this calorie intake is examined at per cent of adequacy level,

it was found in excess. There is negatively significant difference when compared with their standards. The amount of protein consumption by school going obese girls was reported as 46.5g which is noticed negatively significant difference. The per cent of adequacy level for protein was noted excess *i.e.* 253.1 per cent. Fat consumption in girls was recorded as 44g and per cent of fat consumption was reported as in excess(146.7%). There is also noticed negatively significant difference.

In case of consumption of B-complex vitamins like Vitamin B₁(mg), Vitamin B₂(mg) and Vitamin B₃(mg), Vitamin C(mg) and β-carotene(μg)were found non-significantly lower than that of their Standards. Vitamin B₁ (0.88mg), Vitamin B₂ (0.95mg) and 11.0mg Vitamin B₃ (11.0mg) consumption were seen in boys. However intake of vitamin B₃ in girls was noticed more poor adequate level. The consumption of vitamin C (mg) and β-carotene (μg) were 38.5 and 4180, respectively. The consumption was noticed in poor adequate level *i.e.* 84.6 and 96.3 per cent, respectively when compared with their RDA.

Table 7 : Average nutrients intake by obese boys of 10 to 12 years

Nutrients	RDA	Average nutrients intake	Z values	Per cent of adequacy
Calories(Kcal)	2190.0	2475.0	--(5.5)**	113.0
Protein(g)	39.9	51.5	-(4.0)**	129.1
Fat(g)	35.0	52.0	-(4.1)**	148.6
Vitamin B ₁ (mg)	1.1	0.85	(0.2) ^{NS}	77.3
Vitamin B ₂ (mg)	1.3	1.1	(0.5) ^{NS}	84.6
Vitamin B ₃ (mg)	15.0	12.6	(2.6)*	84.0
Vitamin C(mg)	40.0	31.5	(3.5)**	78.8
-carotene(μg)	4800.0	3400.0	(8.5)**	70.8
Calcium(mg)	800.0	560.0	(2.9)**	70.0
Iron(mg)	21.0	20.5	(1.8) ^{NS}	97.6

* and ** indicate significance of values at P=0.05 and 0.01, respectively

NS=Non-Significant

Table 8 : Average nutrients intake by obese girls of 10 to 12 years

Nutrients	RDA	Average nutrients intake	Z cal	Per cent of adequacy
Calories(Kcal)	2010.0	2340.0	--(10.4)**	116.4
Protein(g)	40.4	47.5	-(3.0)**	117.6
Fat(g)	35.0	48.0	-(4.1)**	137.0
Vitamin B ₁ (mg)	1.0	0.85	(0.7) ^{NS}	85.0
Vitamin B ₂ (mg)	1.2	1.05	(0.3) ^{NS}	87.5
Vitamin B ₃ (mg)	13.0	11.95	(0.7) ^{NS}	91.9
Vitamin C(mg)	40.0	37.0	(1.2) ^{NS}	92.5
-carotene(μg)	4800.0	3400.0	(8.5)**	70.8
Calcium(mg)	800.0	455.0	(5.6)**	56.9
Iron(mg)	27.0	22.0	(2.3) ^{NS}	81.5

** indicate significance of value at P=0.01

NS= Non-significant

The mineral intake such as calcium (mg) and iron (mg) among school going girls were noted 385 and 15 respectively. The intake level of calcium and iron were less and did not reach their daily intake recommendations. This may be because many girls showed very less intake of green leafy vegetables and milk.

In the same way as boys, the schools going obese girls are also noticed excess consumption of major nutrients such as calories, protein and fats whereas minor nutrients intake was noted at inadequate level.

The data about average nutrients intake of school going obese children of age in 10 to 12 years was kept in Table 7 and 8.

Data presented in Table 7 is clearly stated that the average calorie intake by school going boys was noted 2475 Kcal. When this calorie intake is checked at per cent of adequacy level, it was found in excess (113%). There is negatively significant difference when compared with standards. The amount of protein consumption by school going obese boys was reported 51.5g which is noticed negatively significant difference. Whereas Fat consumption in boys was recorded as 52g and per cent of fat consumption was reported as in excess (148.6%). There is also noticed negatively significant difference.

A non-significant difference was noticed as compared with their RDA of B-complex vitamins like vitamin B₁ (mg), vitamin B₂ (mg) and vitamin B₃ (mg), Vitamin C (mg) and β-carotene (μg) were also calculated in comparison with their Standards. About 0.85mg of vitamin B₁, 1.1 mg of vitamin B₂ and 12.6mg of vitamin B₃ consumption were seen in boys. The vitamins consumption in boys was noticed in poor adequate level *i.e.* 77.3, 84.6 and 84 per cent for vitamin B₁, B₂ and B₃, respectively. The consumption of vitamin C (mg) and β-carotene (μg) were 31.5 and 3400, respectively. The consumption was notice in poor adequate level *i.e.* 78.8 and 70.8 per cent, respectively when compared with RDA.

The mineral intake such as calcium (mg) and iron (mg) were noted less adequate level among school going boys. The calcium intake was reported as 560 mg, whereas only 20.5 mg iron intake was found among 10-12 years obese boys.

The data given in Table 8 exhibits the average nutrients intake by 10-12 years in age school going obese girls.

Table 8 reveals that the average calorie intake by

school going girls was noted 2340 Kcal. When this calorie intake is checked at per cent of adequacy level, it was found in excess (116.4). There is negatively significant difference found it was when it was compared with their standards. The amount of protein consumption by school going obese girls was reported 47.5g which is noticed negatively significant difference. The per cent of adequacy level for protein was noted excess *i.e.* 117.6 per cent. Fat consumption in girls was recorded as 48g and per cent of fat consumption was reported as in excess (137.1%). There is also noticed negatively significant difference.

B-complex vitamins like Vitamin B₁ (mg), Vitamin B₂ (mg) and Vitamin B₃ (mg), Vitamin C (mg) and β-carotene (μg) consumption were also calculated in comparison with their Standards. It shows that 0.85mg of Vitamin B₁, 1.05mg of Vitamin B₂ and 11.95mg of Vitamin B₃ consumption were in boys. There is no significant difference when compared with RDA. The vitamin B complex consumption in girls was noticed in poor adequate level. The consumption of vitamin C (mg) and β-carotene (μg) whereas 37 and 3400, respectively. This consumption was noticed in poor adequate level *i.e.* 92.5 and 70.8 per cent, respectively when compared with RDA.

Conclusion:

On the whole it can be concluded that the food intake especially cereals, pulses and fat based foods are found significantly excess in these school going children. Vegetables and fruits consumption noted less by these children. However the nutrients intake *i.e.* energy and protein were noticed excess than that of their standard level. Whereas vitamins and minerals intake were found less among these children.

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